

### **REMARKS**

At the outset, Applicants acknowledge with appreciation the courtesy of Examiner Prem Singh and Supervisory Patent Examiner (SPE) Glenn Caldarola in conducting the April 28, 2009 personal interview. During the personal interview, Applicant, Applicant's representative, Examiner Singh and SPE Caldarola discussed proposed claim amendments and arguments for overcoming the rejection of claims 1-7 under 35 U.S.C. § 103.

Claims 1-7 are rejected under 35 U.S.C. §103(a) as being unpatentable over Ward (U.S. Patent No. 5,350,501) ("Ward"). This rejection is respectfully traversed.

The subject matter of claims 1-7 would not have been obvious over Ward. Ward does not disclose or suggest all limitations of claim 1. Ward does not disclose or suggest a catalyst support based on beta zeolite having a silica-alumina molar ratio of at least about 250. Ward discloses SiO<sub>2</sub>:Al<sub>2</sub>O<sub>3</sub> molar ratios for zeolite beta of at least 10 and up to about 100, with a preferred range of 10 to 40, and most preferably in the range of 20 to 30. Ward specifically teaches that "[Z]eolite Beta is prepared, in general, as an aluminosilicate zeolite having a silica-to-alumina molar ratio (SiO<sub>2</sub>:Al<sub>2</sub>O<sub>3</sub>) of at least 10 up to about 100, but preferably no more than about 40, and most preferably in the range of 20 to 30" (col. 4, ll. 3-7). In fact, in example 1 of Ward, the molar ratio of zeolite beta is as low as 26.

Although Ward states that SiO<sub>2</sub>:Al<sub>2</sub>O<sub>3</sub> molar ratios of 500:1 or more can be used, Ward also specifically emphasizes that zeolite beta at these high molar ratios have little or no zeolitic properties ("It may also be prepared in yet higher silica-to-alumina mole ratios, e.g., 500:1 or more" but "such materials may have little or no zeolitic properties" (col. 4, ll. 7-9)). Thus, if anything, Ward teaches against the use of "higher silica-to-alumina mole ratios, e.g., 500:1 or more" as these ratios higher than 100:1 provide materials with "little or no zeolitic properties" (A prima facie case of obviousness may be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. *In re Geisler*, 116 F.3d 1465, 1471 (Fed. Cir. 1997)).

This is contrary to the findings of the claimed invention, where molar ratios of as high as 1500:1 for zeolite beta (used with the high ratios for zeolite Y) have been found to be zeolitically active in low aromatic middle distillate production. Examples 1, 2 and 3 of the specification clearly illustrate that the  $\text{SiO}_2:\text{Al}_2\text{O}_3$  molar ratios for zeolite beta are 1500:1, 1500:1, and 300:1, respectively, values which are significantly higher than the “silica-to-alumina molar ratio ( $\text{SiO}_2:\text{Al}_2\text{O}_3$ ) of at least 10 up to about 100, but preferably no more than about 40, and most preferably in the range of 20 to 30” of Ward.

Although Ward discloses molar ratios for zeolite Y from “4.5 to 35” (col. 5, l. 49), Ward specifically teaches that low  $\text{SiO}_2:\text{Al}_2\text{O}_3$  molar ratios for zeolite Y are preferred (of preferably 4.5 to 9) and exemplifies very low values of 5.2 and 5.7 (refer to example 1, preparation of catalysts 2 and 3). The claimed invention requires a Y zeolite having “a molar  $\text{SiO}_2:\text{Al}_2\text{O}_3$  ratio of at least 15,” which (although falling within the broad range disclosed by Ward) is nonetheless much larger than the preferred ranges of Ward and than the specific examples of Ward.

Ward teaches the use of zeolites with low  $\text{SiO}_2:\text{Al}_2\text{O}_3$  ratios for both zeolite beta and zeolite Y. A person skilled in the art would not have been motivated by Ward to use zeolite Y with a molar  $\text{SiO}_2:\text{Al}_2\text{O}_3$  ratio of at least 15 or zeolite beta with high  $\text{SiO}_2:\text{Al}_2\text{O}_3$  molar ratio of at least 250, since Ward specifically teaches that the former compound preferably uses low molar ratios and the latter compound has little or no zeolitic properties. Thus, Ward teaches away from the claimed invention and does not provide any hint as to the synergistic effect observed with respect to reduced aromaticity and improved pour point of middle distillates (as in the claimed process) when using a combination of zeolites beta and Y having the claimed  $\text{SiO}_2:\text{Al}_2\text{O}_3$  molar ratios.

Applicants also submit that the range disclosed in the claimed invention (zeolite Y with a molar  $\text{SiO}_2:\text{Al}_2\text{O}_3$  ratio of at least 15 and zeolite beta with high  $\text{SiO}_2:\text{Al}_2\text{O}_3$  molar ratio of at least 250) is critical. The specific molar  $\text{SiO}_2:\text{Al}_2\text{O}_3$  ratios of the zeolite Y and zeolite beta confer specific, unexpected results for the middle distillate, i.e., lowering of both the content of aromatic compounds and the pour point relative to the content of aromatic compounds, the pour point of a middle distillate being obtained by contacting the feedstock with a catalyst comprising only a Y

zeolite. This aspect is neither disclosed nor suggested in any way in Ward -- and could not have been disclosed or suggested -- simply because, as noted above, the catalyst of Ward is different from that of the claimed invention.

To produce high yields of low aromatic middle distillate, weaker acidity and strong hydrogenation activity of the catalyst is required to minimize secondary cracking and maximize aromatic saturation. The low content of the beta zeolite and zeolite Y, both of which have low acidity due to the high silica-alumina ratio, ensures a very low acidity of the catalyst support and, in combination with a high hydrogenation /acidity ratio, ensures high degree of aromatic saturation. This aspect is exemplified in examples 1 to 3 (for instance), where the sum of the content of zeolite beta and zeolite Y totals 10 wt %. This low concentration is shown to have a positive effect leading to a reduction in aromatic content (refer to the results shown in table 3 of the specification).

Ward mentions low concentrations of 5 to 50 wt % of combined amounts of zeolite beta and zeolite Y as being suitable for selectively producing middle distillates (refer to col. 8, lines 26 to 44). However, in all the examples, a total zeolite amount of 64% is used, resulting in a catalyst acidity that is much higher than that of the catalysts used in the inventive process and thereby having a high cracking activity. Thus, the hydrogenation/acidity ratio is low, and aromatic compounds are not hydrogenated but cracked instead, and this zeolite combination is thus more suitable for preparing gasoline than middle distillates. This is confirmed by the results in table II, which show that catalysts 2 and 3 provide increased activity for light gasoline with boiling point range 50-185°F (10-85°C) and naphtha within boiling point range 185-420°F (85-215°C) and for the lower end of middle distillates 300-550°F (148-288°C).

Ward discloses in table IV the selectivity vol. % converted to turbine fuel at activity temperature 300-550F (148C-287F) and to diesel at activity temperature 300-700F (148-371F), using catalyst 9. The selectivity vol. % for these two fractions shows that the amount of diesel formed from 550F to 700F corresponds to a selectivity vol. % of 5.7, which is very low, indicating that catalyst 9 is not suitable for producing heavy diesel, which is formed primarily at the high activity temperature. There is no mention of the aromatic content of the diesel prepared.

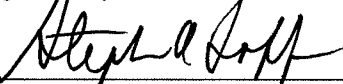
Catalyst 9 of Ward is identical to catalyst 2, and there is no available information regarding the beta zeolite used in catalyst 2. However, preferable silica-alumina values for the beta zeolite are 20-30 and the Y zeolite used in catalyst 2 has a silica-alumina ratio of 5.2, both values being much lower than the silica-alumina values of the catalyst used in the process of the claimed invention. Catalysts 2 and 9 are thus not identical to the catalyst used in the process of the claimed invention, and they also are not able to produce high amounts of diesel.

The process of the claimed invention provides a low aromatic middle distillate product with lower pour point. The lowering of the pour point is a distinct improvement and allows the end point of the diesel fraction to be, if not limited, increased significantly; thus, due to increased boiling range, the process of the claimed invention results in increased production of middle distillates. These advantages are neither disclosed nor suggested by Ward.

Allowance of all pending claims is solicited.

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